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THE OPERATIVE TREATMENT OF HERNIA.

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THE problem is to close durably a rent in the abdominal wall and to provide for the safe transmission of the spermatic cord. The cord is the first cause of the hernia and the ultimate obstacle to its cure. If we could ignore the cord, the solution of the problem would be comparatively easy. The larger the cord the greater the liability to a recurrence of the hernia. The size of the cord depends chiefly upon the veins. Then why not reduce the size of the cord by excising such veins as may be superfluous? By this procedure the cord may usually be reduced to less than one-third, and sometimes to one-fifth or one-sixth of its original size. Two quite distinct sets of veins accompany the vas deferens. When the tunica vaginalis propria funiculi spermatici has been divided and the elements of the cord are gently spread out by the fingers the larger superfluous bundle of veins lies at some distance from the vas deferens. A few very delicate veins hug the vas deferens closely. The veins which we designate as "superfluous" are those which I regularly excise in operations for varicocele. We have not thus far seen atrophy¹ of the testicle follow excision of these veins. Our cases have been observed with especial reference to this point. I think that there can be little doubt as to the advisability of reducing the size of the cord by excising these veins when they form a large bundle.

Let us consider next the closing of the hole in the abdominal wall. What tissues shall we employ and how shall we bring these tissues together? It has been demonstrated too often that the stitching of the pillars of the ring does not suffice. We must do more than bring free edges of the aponeurosis of the external oblique muscle together. Fortunately we have muscles so near at hand and so placed as to suggest at once a simple, and what has proved to be an entirely effective, plastic operation. After cutting through the anterior wall of the canal down to the sac, we continue the incision in the same line, outward and a little upward, through the internal oblique and trans-

¹ May 15, 1895. In three of our cases atrophy of the testicle has been caused by the operation. The atrophy is probably due to the excision of the veins, for it has occurred thus far only in the cases in which the veins were excised.—W. S. HALSTED.



versalis muscles for an inch or less. We divide the muscle-bundles about at right-angles to their long axes. Thus two flaps of muscle are obtained, which we draw down into the canal and include in the deep stitches in the way to be described. The uppermost bundles of the *cremaster* muscle are often so heavy that we can use them for the same purpose. We close the rent which Nature has made and which the knife has enlarged with mattress-sutures, precisely as we close all abdominal wounds. The mattress-suture is to be preferred to other sutures because it constricts the tissues less, holds greater surfaces in contact, and insures, ultimately, more accurate apposition of the several planes of tissue. These stitches bring surfaces together at the outset, just as in sutures of the intestines the walls of the intestine, irrespective of the stitch, are always brought together. The walls of the intestine are so inverted that the muscular surfaces (so-called peritoneal surfaces) are extensively in contact, the cut edges never. And yet after a few weeks no trace of the inversion remains. Sometimes an almost imperceptible dark line is left to indicate the position of the cicatrix. With the aid of the microscope we see that the finest layer has met its fellow and may be traced uninterruptedly through the cicatrix, and were it not for the rudimentary character of a few of the villi we might search in vain for evidence of the solution in continuity.

Dr. Mall,¹ for whom I performed some experiments which necessitated circular suture of the intestine, describes the microscopical appearance of an intestinal suture of sixty-four days as follows: "Fig. 12 shows a section of this suture which strikes the stitches. Were it not for this stitch and a slight infiltration of that part with leucocytes the point of suture could not be made out. To be sure, the microscope shows very rudimentary villi which could easily be overlooked when compared with the other folds which this intestine contains. The crypts are fully regenerated and cannot be differentiated from the surrounding crypts. The stratum fibrosum, muscularis mucosæ, submucosa, and two muscular coats are all reproduced and form one straight line. The regeneration is so complete that the two layers of the regenerated muscularis mucosæ can be made out."

There are usually six of these deep stitches. They are taken very close together, not more than 1 cm. apart. The two arms of each stitch are 7 or 8 mm. apart. The *vas deferens*, with its arteries and remaining veins, is brought forward between the two outermost stitches. These two stitches are closer together than the others and embrace the cord snugly. The outer arm of the outermost stitch is sometimes passed through uncut muscle.

When the deep wound is closed muscle should be seen throughout the greater part of it, projecting between the cut edges of the aponeu-

¹ Johns Hopkins Hospital Reports, vol. i. p. 90.

rosis of the external oblique muscle. These edges are then made to embrace the cord more snugly at the point where it passes between them by two very fine stitches. The skin-incision is closed with an uninterrupted suture. As we approach, in stitching, the lower inner angle of the deep wound the muscle becomes thinner and finally gives out. The aponeurosis of the external oblique, with perhaps a few fibres of the cremaster, is all that is left for the innermost stitch. If the aponeurosis at this point shows, as it sometimes does, a tendency to split when it is vigorously pulled upon by a stitch, we gather or pucker it up by taking running mattress-sutures in place of the ordinary mattress-sutures. In running the stitches I try to avoid perforating the aponeurosis. The puckering is, of course, only a temporary affair, but the running stitches enable us to close the lower angle of the deep wound with less damage to the aponeurosis.

In short, we close our hernia-wounds precisely as we close all wounds of the abdomen, except that in hernia alone we stitch the peritoneum separately. In wounds of the linea alba we split the sheaths of the recti muscle, whether we are operating for the cure of hernia or not, that we may oppose broad surfaces of muscle throughout the whole length of the incision.¹ For the same reason, and also that we may transplant the cord in the male and the round ligament in the female, we divide the internal oblique and transversalis muscles when operating for the cure of inguinal hernia.

I shall say but a few words at this time about our results, for Dr. Bloodgood will soon publish a complete report of them.

We have operated one hundred and sixty-five times for the cure of various forms of hernia in both sexes without a death from the operation. One hundred and six males with inguinal hernia have been operated upon by my method. The wounds, with few exceptions, have healed absolutely *per primam*. Thus far we have been unable to find a single recurrence in cases whose wounds healed *per primam*. The case which furnishes the nearest approach to a recurrence was operated upon about three years ago and is now under daily observation. The man has the physiognomy of a Hindoo, but is classed as a negro. He is about thirty-five years old, not much more than half-witted, and was on admission, and still is, much emaciated and exceedingly feeble. Within the first twenty-four hours he got out of bed. Possibly he repeated this act of disobedience daily. The wound healed absolutely *per primam*. There is at present, but only on coughing, a bulging of the very thin, flabby abdominal wall from the inner almost to the outer

¹ In a recent number of the Centralblatt für Chirurgie, P. Bruns, of Tübingen, describes and recommends a method for the cure of ruptures in the linea alba which, except that he does not employ the mattress-sutures, is identically ours for closing all incisions in the linea alba.

end of the scar. The local condition is not bad enough to demand a second operation.

I dislike to have my operation referred to as a modification of Bassini's operation. The operations are undoubtedly original with both of us, and mine was described several months before we had heard of Bassini's operation. You may know that in my operation the cord which is transplanted out into the thicker muscle lies superficial to the aponeurosis of the external oblique muscle, and not, as in Bassini's operation, in a fold of and under this aponeurosis. In Bassini's operation the circulation of the aponeurosis must be impaired, both by the foldings of the aponeurosis near Poupart's ligament and by the stitches which temporarily maintain them. Furthermore, Bassini's method does not, as he claims, re-establish the obliquity of the canal. Bassini believes that he restores the inguinal canal to its physiological condition when he makes "a canal with two openings, an abdominal and a subcutaneous opening, and with two walls, a posterior and an anterior, through the middle of which the cord passes obliquely." But the original canal is not by any means an affair so simple as Bassini's. To reproduce the equivalent, anatomically and physiologically, of the inguinal canal is for us impossible.

For about one year I have sewed all of my hernia-wounds with silver wire and have covered them with silver-foil. Without exception the wounds have healed absolutely *per primam*. Not a single stitch-abscess has been observed either during or subsequent to the healing of the wound. Such absolutely perfect healing of the hernia-wounds we have not had heretofore, and I am convinced that the use of silver as a suture-material has contributed somewhat to this result. We have tested the effect of silver on the growth of the more common pyogenic organisms. I have here two Pétri-plates which Dr. Bolton has kindly prepared for me. They have both been inoculated with *staphylococcus pyogenes aureus*. In the centre of each plate is a piece of silver-foil, such as we use on our wounds. Just outside, and completely surrounding the foil, is a perfectly clear zone several millimetres wide. Except for the clear zone and a slightly intensified zone just outside of this, the agar is quite uniformly cloudy. The cloudiness is due to the growth of the micro-organisms with which the agar has been inoculated. Dr. Bolton has studied the effects of various metals on the growth of bacteria, and has recently read a most interesting paper on this subject before the Association of American Physicians. With cadmium, zinc, and copper, Dr. Bolton observed that the inhibitory action was greater than with silver. Prior to my knowledge of Dr. Bolton's experiments I tried to use copper and brass foil for protective, and copper and brass wire for sutures; but these metals corroded the tissues so much that I soon stopped using them. We do not hesitate to employ buried sutures of silver wire in sew-

ing tissues on the confines of an infected region. In cases of acute suppurative appendicitis, for example, we close the wound in the abdominal wall with deep, interrupted, buried sutures.¹ These wounds are drained by a few strips of gauze. Two of the sutures are taken very close to this gauze, and sometimes must pass through tissues which are infected. Not even in such cases have we ever had a stitch-abscess. Once a silver stitch and once a silver bone-plate, having been exposed to view and to the air by necrosis of the overlying tissues, were allowed to remain and to become imbedded in the granulations of the wound, which healed by suppuration. Neither the stitch nor the plate at any time caused the slightest disturbance in the tissues or inconvenience to the patient.

We have already observed much in the use of silver wire that is worth recording and enough to satisfy us that it will play a new and more important rôle in the surgery of the near future.

¹ Vide Bulletin of the Johns Hopkins Hospital, November, 1894.

